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Applicant(s): ROGER LAM ET AL.

Docket No.

FIS920030398US1

Application No.

10/708,066

Filing Date

02/06/2004

Examiner

B. CHERVINSKY

Group Art Unit

2835

Invention: METHOD AND STRUCTURE FOR HEAT SINK ATTACHMENT IN SEMICONDUCTOR DEVICE
PACKAGING

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Transmittal and Reply Brief

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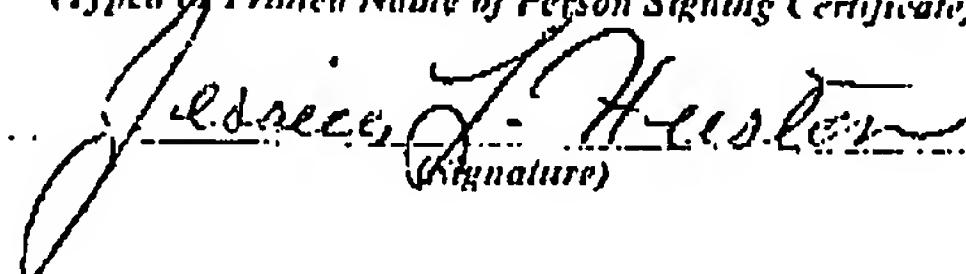
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TRANSMITTAL LETTER
(General - Patent Pending)

Docket No.
FIS920030398US1

In Re Application Of: ROGER LAM ET AL.

| Application No. | Filing Date | Examiner | Customer No. | Group Art Unit | Confirmation No. |
|-----------------|-------------|---------------|--------------|----------------|------------------|
| 10/708,066 | 02/06/2004 | B. CHERVINSKY | 29371 | 2835 | 2065 |

Title: METHOD AND STRUCTURE FOR HEAT SINK ATTACHMENT IN SEMICONDUCTOR DEVICE
PACKAGING

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Transmitted herewith is:

Reply Brief

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Dated: March 21, 2006

Sean F. Sullivan
Reg. No. 38,328
Cantor Colburn LLP
55 Griffin Road South
Bloomfield, CT 06002
860-286-2929

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: ROGER LAM, ET AL.)
Serial No.: 10/708,066) Group Art Unit: 2835
Filed: February 6, 2004)
For: METHOD AND STRUCTURE FOR) Examiner: Chervinsky, B.
HEAT SINK ATTACHMENT IN) Confirmation No.: 2065
SEMICONDUCTOR DEVICE)
PACKAGING)

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REPLY BRIEF

In response to the Examiner's Answer mailed on February 16, 2006, Applicants hereby submit the following Reply Brief, pursuant to 37 CFR 41.41 and MPEP 1208.

1. STATUS OF THE CLAIMS

Claims 1-20 stand rejected as more fully set forth below. The final rejection of claims 1-20 is appealed.

2. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The grounds of rejection to be reviewed on appeal are:

(A) whether the Examiner's rejection of claims 1, 4, 6, 8, 11, 14, 17 and 19 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent 6,218,730 to Toy, et al. is improper; and

(B) whether the Examiner's rejection of claims 3, 5, 7, 10, 12, 13, 16, 18 and 20 under 35 U.S.C. §103(a) as being unpatentable over Toy, et al., and whether the Examiner's rejection of claims 2, 9 and 15 under 35 U.S.C. §103(a) as being unpatentable over Toy, et al., in view of U.S. Patent 6,730,993 to Boyer, et al. is improper.

3. ARGUMENT

The Toy Reference differentiates between a “thermal spreader” and a “heat sink.” Moreover, there is a functional and structural difference between a thermal spreader and a heat sink.

On pages 4-5 of the Examiner’s Answer, the position is taken that the term “thermal spreader,” as used in the Toy reference, has been narrowly construed by the Appellants, and that element 20 functions as a heat sink because it does not just distribute heat more evenly from a source, but also dissipates heat to an environment or inherently functions as a heat sink. The Appellants, however, respectfully submit that this is not in fact the case.

As is known in the art, a heat sink for integrated circuit chips typically consists of a metal structure with one or more flat surfaces to ensure good thermal contact with the component(s) to be cooled, as well as an array of comb or fin like protrusions to increase the surface contact with the air, and thus the rate of heat dissipation. Accordingly, a heat sink facilitates cooling through both conduction (transfer of heat across matter) and convection (transfer of heat by currents in a fluid) mechanisms. That is, the flat base portion of a heat sink receives heat transfer from another object in contact therewith (e.g., a chip, heat spreader, thermal spacer, grease, etc.). Then, the heat is dissipated from the heat sink to the ambient through convection.

In contrast, a thermal spreader utilizes only thermal conduction to spread heat (from an object in contact therewith) evenly across the device. In each embodiment depicted in the Toy reference, the lid 20 has a flat surface without any protrusions for increasing surface area that are characteristic of a heat sink.

Using the Examiner’s reasoning, any object in contact between a heat generating

component and the ambient would inherently function as a heat sink, regardless of whether that object is configured for convective cooling with respect to with the ambient. The Appellants respectfully submit that this is an overly broad interpretation of the term "heat sink."

Naturally, any component in thermal contact between a heat generating object and the ambient would tend to transfer this heat to the cooler ambient. However, inherent in the term "heat sink" is a capability of rapid transfer of the heat to the ambient; otherwise, the component would not accomplish the desired rapid cooling for proper IC functionality. In a heat sink, this rapid transfer is enabled by the increased surface area of the fins, which facilitates the convective cooling.

The fact that the lid 20 shown in Figure 5 of Toy is extended more horizontally with respect to other lid embodiments in Toy simply means that the heat conductively transferred to the lid is spread throughout a larger structure. However, without structural provisions for facilitating convective transfer to the ambient, the Figure 5 embodiment of the lid would not provide any significant increase in the rate of cooling with respect to the other, slightly smaller lids. Thus, contrary to the Examiner's Answer, the modification of lid to extend in the horizontal direction would not be for the purpose of functioning as a heat sink. Moreover, as taught in Figure 1 of Toy, an actual heat sink 50 may be used where it is desired to provide rapid cooling of the IC 16 through the conductive lid 20.

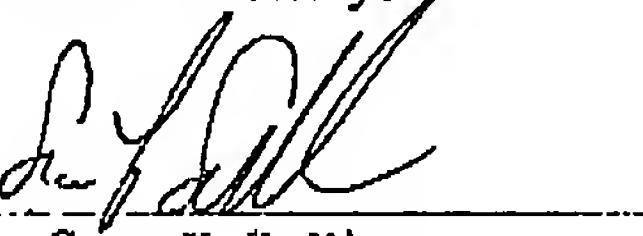
The Appellants therefore respectfully reiterate that since the claims of the instant application recite a spacer member in contact between the substrate surface and the heat sink, a determination that Toy meets this element is in clear error because the lid 20 is not a heat sink. Because the Toy reference fails to teach or suggest at least one spacer member in contact between a substrate surface and a heat sink, the §102(b) rejections of claims 1, 4, 6, 8, 11, 14, 17 and 19, as well as the §103 rejections of claims 2, 3, 5, 7, 9, 10, 12, 13, 15, 16, 18 and 20, should therefore be reversed.

4. CONCLUSION

For the above stated reasons, it is respectfully requested that the rejections of claims 1-20, under each of the grounds outlined in the Final Office Action of August 3, 2005, be reversed. If any fees are due with respect to this Appeal, please charge them to Deposit Account No. 09-0458 maintained by Applicants' attorneys.

Respectfully submitted,
ROGER LAM, ET AL.

CANTOR COLBURN LLP
Applicants' Attorneys

By 
Sean F. Sullivan
Registration No. 38,328
Customer No. 29371

Date: March 21, 2006
Address: 55 Griffin Road South, Bloomfield, CT 06002
Telephone: (860) 286-2929

Appendix -CLAIMS

1. A heat sink attachment structure, comprising:
an integrated circuit chip mounted on a substrate surface;
a thermal interface layer in contact with said integrated circuit chip;
a heat sink in contact with said thermal interface layer; and
at least one spacer member in contact between said substrate surface and
said heat sink, wherein said at least one spacer member is provided with an adhesive
material on top and bottom surfaces therof.
2. The structure of claim 1, wherein said at least one spacer member
comprises a rigid material of a generally cylindrical shape.
3. The structure of claim 2, wherein said at least one spacer member
comprises phenolic.
4. The structure of claim 1, wherein said thermal interface layer is adhesive
free.
5. The structure of claim 1, wherein said adhesive material provided on said
at least one spacer member comprises a reworkable epoxy curable at room temperature.
6. The structure of claim 1, wherein said thermal interface layer further
comprises a thermal interface pad.
7. The structure of claim 6, wherein said thermal interface pad has an initial
thickness of about 6 mil and a compressed thickness of about 4 mils.

8. A method for implementing attachment of a heat sink to an integrated circuit chip, the method comprising:
 - applying a thermal interface layer to the chip;
 - adhesively applying a first side of at least one spacer member to a substrate to which the chip is mounted;
 - aligning the heat sink to the chip; and
 - applying a load to the heat sink until the heat sink is adhesively bonded to a second side of said at least one spacer member.
9. The method of claim 8, wherein said at least one spacer member comprises a rigid material of a generally cylindrical shape.
10. The method of claim 9, wherein said at least one spacer member comprises phenolic.
11. The method of claim 8, wherein said thermal interface layer is adhesive free.
12. The method of claim 8, wherein said adhesive material provided on said at least one spacer member comprises a reworkable epoxy curable at room temperature.
13. The method of claim 8, wherein said thermal interface layer further comprises a thermal interface pad having an initial thickness of about 6 mil and a compressed thickness of about 4 mils.
14. A semiconductor device packaging assembly, comprising:
 - a chip module mounted on a circuit board substrate;
 - at least one integrated circuit chip mounted on said chip module;
 - a thermal interface layer in contact with said at least one integrated circuit

chip;

a heat sink in contact with said thermal interface layer; and
at least one spacer member in contact between said chip module and said
heat sink, wherein said at least one spacer member is provided with an adhesive material
on top and bottom surfaces thereof.

15. The semiconductor device packaging assembly of claim 14, wherein said
at least one spacer member comprises a rigid material of a generally cylindrical shape.

16. The semiconductor device packaging assembly of claim 15, wherein said
at least one spacer member comprises phenolic.

17. The semiconductor device packaging assembly of claim 14, wherein said
thermal interface layer is adhesive free.

18. The semiconductor device packaging assembly of claim 14, wherein said
adhesive material provided on said at least one spacer member comprises a reworkable
epoxy curable at room temperature.

19. The semiconductor device packaging assembly of claim 14, wherein said
thermal interface layer further comprises a thermal interface pad.

20. The semiconductor device packaging assembly of claim 19, wherein said
thermal interface pad has an initial thickness of about 6 mil and a compressed thickness
of about 4 mils.

Appendix -Evidence

None

Appendix - Related Proceedings

None

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